

**Content:** We will give an introduction to Algebraic Geometry, in terms of varieties. We focus primarily on the one-dimensional case of algebraic curves. The main objectives are deriving a local, embedding-free framework for algebraic geometry and the proving the Riemann-Roch theorem for curves. At the conclusion of the course the student should be well equipped to explore higher dimensional algebraic geometry and scheme-theoretic approaches.

We will follow closely the book 'Algebraic curves' by William Fulton, freely available at <https://dept.math.lsa.umich.edu/~wfulton/CurveBook.pdf>

**Assumed Knowledge:** Math3962/Math4062 and Math2022, basic notions of topological spaces and modules over rings.

### Weekly Schedule:

- Week 1: Algebraic sets and the Hilbert Basis Theorem.
- Week 2: Nullstellensatz and polynomial maps.
- Week 3: Rational functions, local rings and discrete valuation ring.
- Week 4: Multiple points and intersection numbers for plane curves.
- Week 5: Projective varieties.
- Week 6: Projective plane curves and Bézout's Theorem.
- Week 7: Noether's Fundamental Theorem, Zariski topology.
- Week 8: Morphisms of varieties and algebraic function fields.
- Week 9: Rational maps and blowing up.
- Week 10: Resolutions of singularities.
- Week 11: Riemann's Theorem.
- Week 12: Riemann-Roch Theorem.
- Week 13: Recap.